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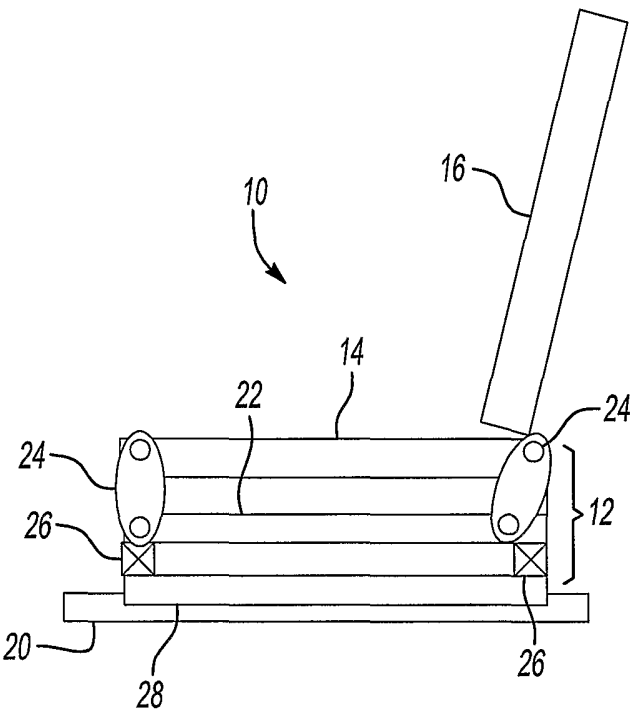
(54) Title: ADJUSTABLE SEAT WITH INTEGRATED OCCUPANT WEIGHT SENSORS



(57) Abstract: A vehicle seat subframe assembly (12) includes a subframe (22) to which are attached a plurality of seat height adjuster links (24) and a plurality of weight sensors (26). The subframe assembly is adapted to be mounted between the vehicle seat (14, 16) and a seat slide assembly (28). In one embodiment, the seat height adjuster links are connected to the seat slide assembly and the weight sensors contact the vehicle seat. In another embodiment, the seat height adjuster links are connected to the vehicle seat and the weight sensors contact the seat slide assembly. Overload bolts provide gaps that protect the weight sensors from being overloaded in the event of a collision.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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ADJUSTABLE SEAT WITH INTEGRATED OCCUPANT WEIGHT SENSORS

This application claims priority to U.S. Provisional Application Serial No. 60/466,933, filed April 30, 2003 and U.S. Provisional Application Serial No. 60/517,581, filed November 5, 2003.

BACKGROUND OF THE INVENTION

This invention relates to vehicle occupant weight sensing and classification and more particularly to occupant weight sensing and classification in an adjustable seat.

An automotive car seat typically includes a seat base and a seat back and is mounted to an automobile chassis by a support arrangement. In an adjustable automotive car seat, the support arrangement is usually movable by means of electric motors and connected to the seat by four pivoted links. One example is shown in WO 02/074575.

Generally, it is sometimes desirable to determine the weight, classification and position of an occupant of a seat in a vehicle passenger compartment. For example, based upon the weight of the occupant and the position of the occupant on the seat, an active safety restraint system may determine whether or not to deploy or may determine the amount of force with which to deploy. One way of achieving this is by using a plurality of load cells mounted beneath the vehicle seat.

Prior art implementations of weight sensors in adjustable vehicle seats have had some drawbacks. For example, implementing weight sensors in adjustable vehicle seats has often required a complete redesign of the vehicle seat structure in order to accommodate the sensors. Also, many of the prior art designs leave the sensors vulnerable to severe overloads in the event of a collision, such that the sensors would have to be replaced at additional cost.

The use of weight sensors below the vehicle seat has also been complicated by the over-cinching of the seat belt. If the seat belt is cinched tightly on a child seat, this increases the weight reading on the weight sensors. The increase in weight on the sensors by the cinched seat belt could incorrectly lead to the determination

that an adult is in the vehicle seat. To overcome this problem, some systems incorporate a belt load sensor, which measures the tension in the seat belt so that it can be subtracted from the weight sensors reading to determine the occupant weight. However, the belt load sensor increases the overall cost of the system.

SUMMARY OF THE INVENTION

The present invention provides an improved adjustable seat with weight sensors. The invention could be applied to both a manual adjustable seat and a power adjustable seat. Therefore, unless otherwise specified, the term "adjustable" is intended to include manual and power adjustable seats.

The present invention provides an improved vehicle seat subframe assembly that can be installed in existing adjustable vehicle seat designs without substantial modification. The subframe assembly includes a subframe to which are attached a plurality of seat height adjuster links and a plurality of weight sensors. The subframe assembly is adapted to be mounted between the vehicle seat and a seat slide assembly. In one embodiment, the seat height adjuster links are connected to the seat slide assembly and the weight sensors contact the vehicle seat. In another embodiment, the seat height adjuster links are connected to the vehicle seat and the weight sensors contact the seat slide assembly. Overload bolts provide gaps that protect the weight sensors from being overloaded in the event of a collision.

In either embodiment, the seat occupant weight sensors are safe when abnormal force acts on the seat. The gap between the rigid frame and the seat base protects sensors from being overloaded. Within a predetermined range the seat occupant weight sensors experience restricted seat displacement relative to the support arrangement. This is especially true for power adjustable seats. Use of the vehicle seat subframe of the present invention in an existing adjustable seat design causes little or no increase in overall seat height.

BRIEF DESCRIPTION OF THE DRAWINGS

Other advantages of the present invention can be understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Figure 1 is a schematic representation of a vehicle seat assembly according to a first embodiment of the present invention.

Figure 2 is a perspective view of the seat subframe assembly and seat slide assembly from Figure 1.

Figure 3 is an enlarged bottom perspective view of one front corner the assembly of Figure 2.

Figure 4 is an enlarged bottom perspective view of one rear corner of the assembly of Figure 2.

Figure 5 is an enlarged top perspective view of the rear corner of the assembly of Figure 4.

Figure 6 is a sectional view along lines 6-6 of Figure 5.

Figure 7 is a schematic view of a vehicle seat assembly according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A vehicle seat assembly 10 according to a first embodiment is shown schematically in Figure 1. A seat subframe assembly 12 is mounted below a vehicle seat base 14 and seat back 16 and above lower tracks 20 (one shown). The schematic of Figure 1 shows the components stacked on upon another for clarity, although it should be recognized that in reality there is substantial overlap, such that the overall height of the vehicle seat assembly 10 is not increased.

The seat subframe assembly 12 includes a subframe 22 connected to lower ends of a plurality of seat height adjustment links 24. The seat subframe assembly 12 further includes a plurality of weight sensors 26 mounted to the subframe 22. The weight sensors 26 measure weight between the subframe 22 and an upper seat slide assembly 28.

A perspective view of the seat subframe assembly 12 (without the seat height adjustment links 24) and upper seat slide assembly 28 is shown in Figure 2. The plurality of weight sensors 26 are mounted in mounting sleeves 30 formed at the corners of the subframe 22. A plurality of mounting tabs 34 are formed in the subframe 22 for attaching to the lower ends of the seat height adjustment links 24 (Figure 1).

The upper seat slide assembly 28 includes a pair of seat track slides 40 connected at the front by a front cross member 42 and at the rear by a rear cross member 46. The rear cross member 46 is attached to the rear of the seat slides 40 by rear thrust brackets 48. Shoulder bolts 54 attach the rear thrust brackets 48 and seat belt attachment brackets 50 to the seat slides 40.

Figure 3 is an enlarged bottom perspective view of one front corner of seat subframe assembly of Figure 2. As can be seen in Figure 3, each of the front weight sensors 26 is attached to a mounting hole 60 in the front cross member 42. The front weight sensors 26 measure weight between the subframe 22 and the front cross member 42.

Figure 4 is an enlarged bottom perspective view of one rear corner of the seat subframe assembly of Figure 2. As can be seen in Figure 4, each rear weight sensor 26 is attached to a mounting hole 64 in one of the rear thrust bracket 48. The rear weight sensors 26 measure weight between the subframe 22 and the rear thrust brackets 48.

Figure 5 is an enlarged top perspective view of the rear corner of the seat subframe assembly of Figure 4. Figure 6 is a sectional view along lines 6-6 of Figure 5. Referring to Figures 5 and 6, the subframe 22 includes two weight sensor brackets 66 (one shown) at its rear end protruding beyond the seat. The mounting sleeves 30 are each on a weight sensor bracket 66. This provides seat belt attachment points mechanically linked to the suspended part of the subframe 22. There is a clearance of approximately 3 mm between the bottom face of the weight sensor bracket 66 and the top face of the seat track slide 40. Such a kinematical arrangement of the seat belt attachment points allows elimination of seat belt tension sensors.

The two shoulder bolts 54 are firmly attached to the rear end of each seat track slide 40. The shoulder bolts 54 go through holes 68, 69 in the seat belt attachment bracket 50 and the weight sensor bracket 66. The holes 68, 69 in the seat belt attachment bracket 50 and weight sensor bracket 66 are slightly larger than the diameter of the shoulder bolts 54 to provide a guaranteed clearance relative to the shoulder of the shoulder bolt 54. There is also a clearance between the head of the shoulder bolt 54 and the upper surface of the seat belt attachment bracket 50 and

between the shoulder bolt 54 and the upper surface of the weight sensor bracket 66. Both clearances are important in order to avoid measured force offload in operation. The clearances offload force from the weight sensors 26 in the event of a crash or other unusually high force that would otherwise damage the sensors 26.

Figure 7 is a schematic view of a vehicle seat assembly 110 according to a second embodiment of the present invention. The vehicle seat assembly 110 includes a seat subframe assembly 112 again including a subframe 122 to which are mounted a plurality of weight sensors 126 and the upper ends of a plurality of seat height adjustment links 124. In this embodiment, the weight sensors 126 engage the seat base 114, while the seat height adjustment links 124 connect to the upper seat slide assembly 128.

In accordance with the provisions of the patent statutes and jurisprudence, exemplary configurations described above are considered to represent a preferred embodiment of the invention. However, it should be noted that the invention can be practiced otherwise than as specifically illustrated and described without departing from its spirit or scope.

CLAIMS

1. A vehicle seat subframe assembly comprising:

a subframe;

at least one seat height adjuster link connected to the subframe for connecting the subframe to one of a seat and a seat slide assembly; and

at least one weight sensor on the subframe for measuring weight between the subframe and the other of the seat and a seat slide assembly.

2. The vehicle seat subframe assembly according to claim 1 wherein the at least one weight sensor includes a plurality of weight sensors for measuring weight between the other of the seat and the seat slide assembly.

3. The vehicle seat subframe assembly according to claim 2 wherein the at least one seat height adjuster link includes a plurality of seat height adjuster links connected to the subframe for connecting the subframe to the one of the seat and the seat slide assembly.

4. The vehicle seat subframe assembly according to claim 2 wherein the subframe includes a plurality of mounting sleeves each receiving one of the plurality of weight sensors.

5. The vehicle seat subframe assembly according to claim 4 further including the seat slide assembly connected to the at least one seat height adjuster link.

6. The vehicle seat subframe assembly according to claim 5 further including at least one overload protection bolt connected to the seat slide assembly.

7. The vehicle seat subframe assembly according to claim 6 wherein the at least one seat height adjuster link includes a plurality of seat height adjuster links connected to the subframe for connecting the subframe to the one of the seat and the seat slide assembly.

8. The vehicle seat subframe assembly according to claim 1 further including two seat belt attachment brackets secured to the subframe.

9. A seat assembly comprising:

a seat base;

a subframe;

a seat slide assembly;

a plurality of seat height adjuster links connecting the subframe to one of the seat base and the seat slide assembly; and

a plurality of weight sensors on the subframe for measuring weight between the subframe and the other of the seat base and a seat slide assembly.

10. The vehicle seat subframe assembly according to claim 9 wherein the subframe includes a plurality of mounting sleeves each receiving one of the plurality of weight sensors.

11. The vehicle seat subframe assembly according to claim 10 further including at least one overload protection bolt connected to the seat slide assembly.

12. The vehicle seat subframe assembly according to claim 10 further including two seat belt attachment brackets secured to the subframe.

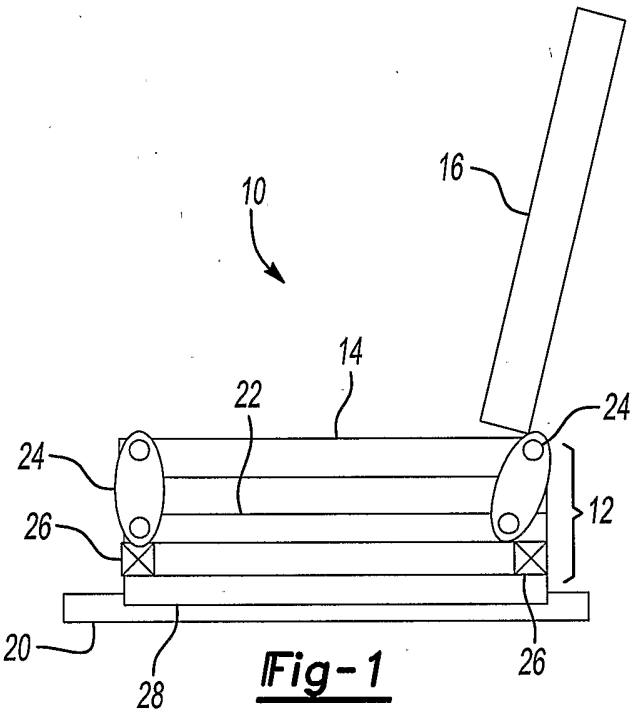
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Fig-1

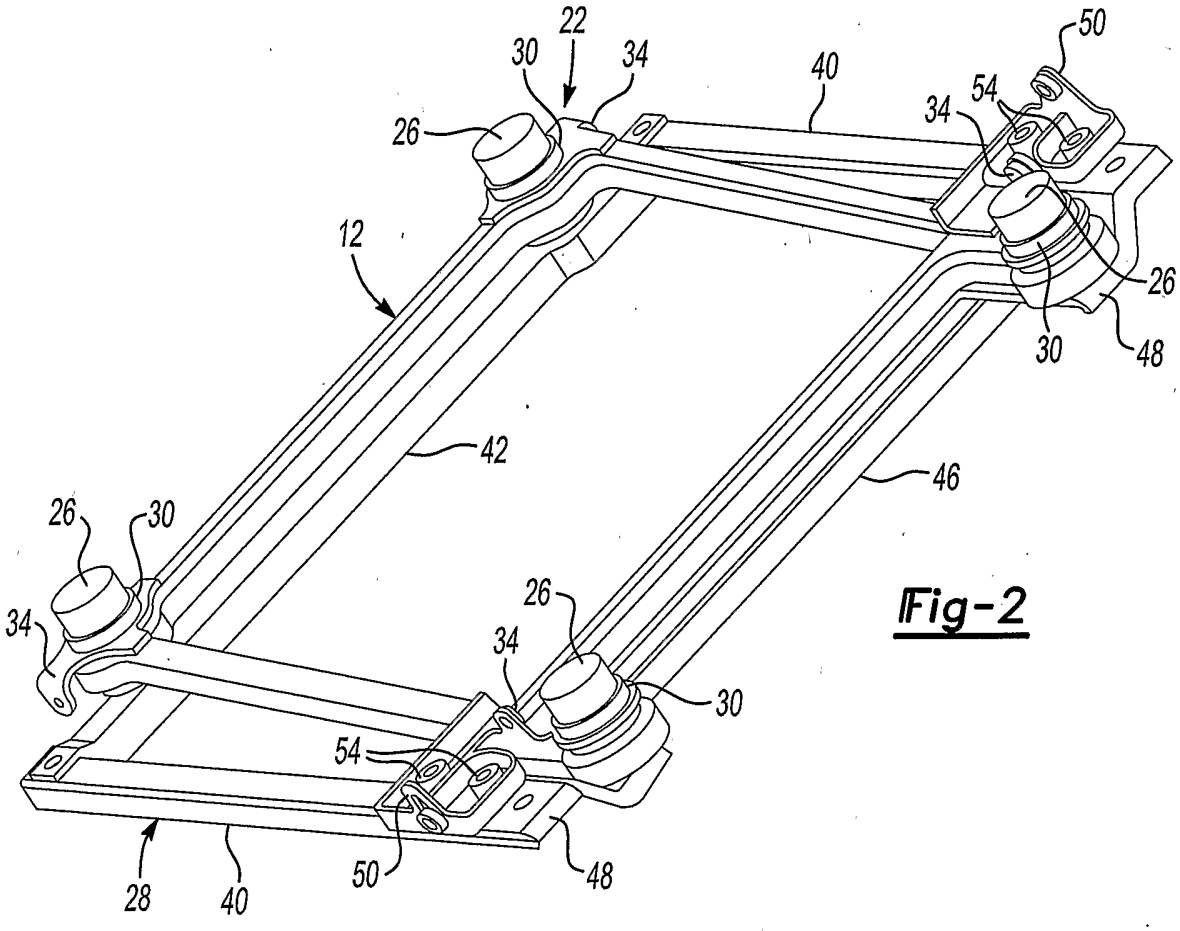
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Fig-2

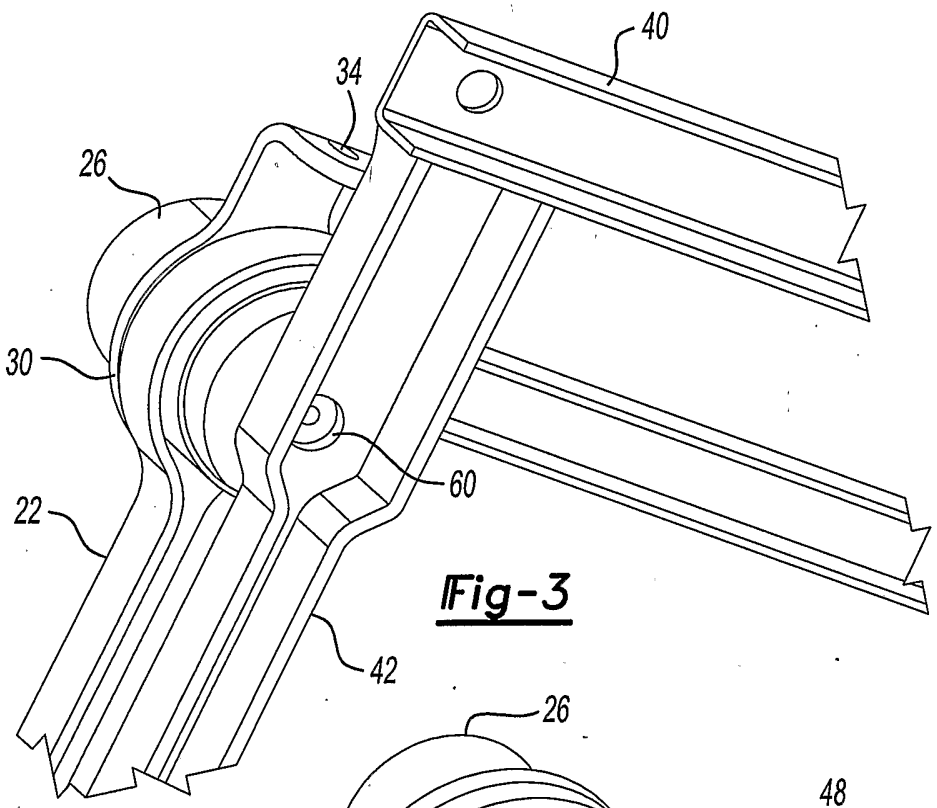

Fig-3

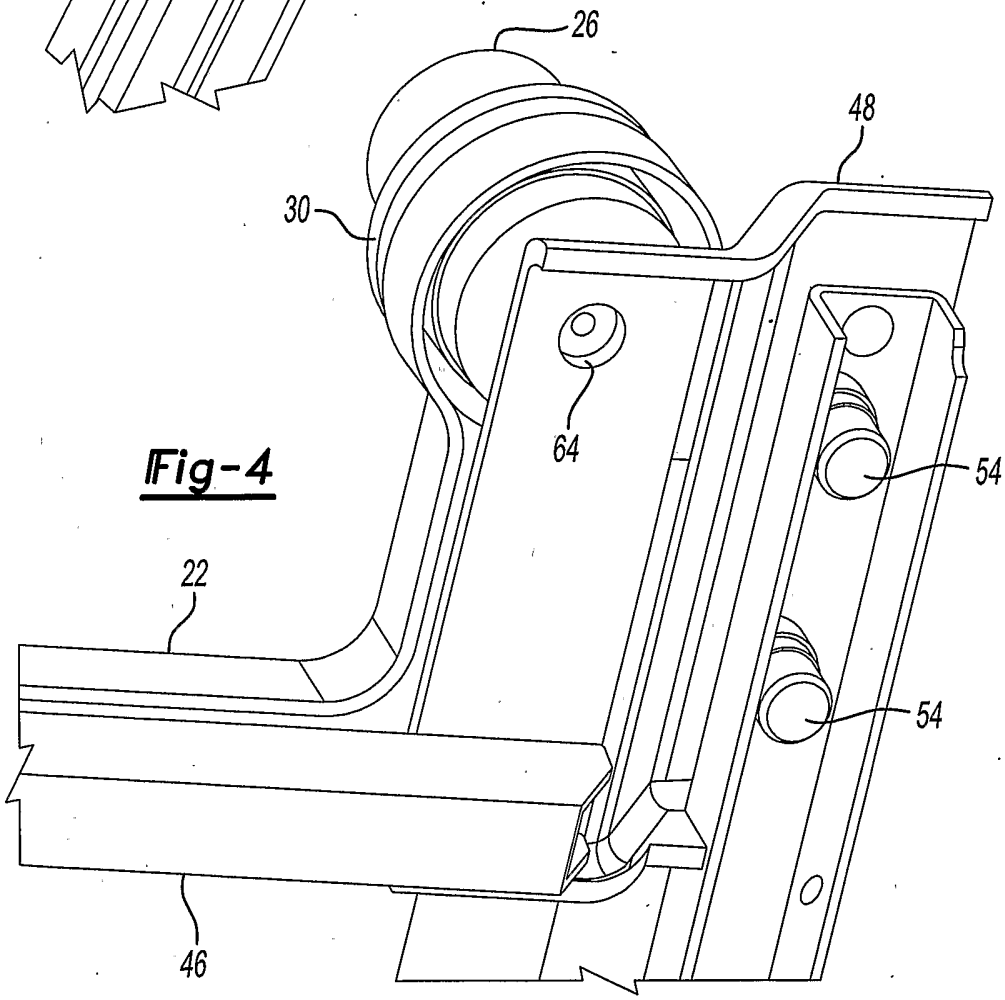

Fig-4

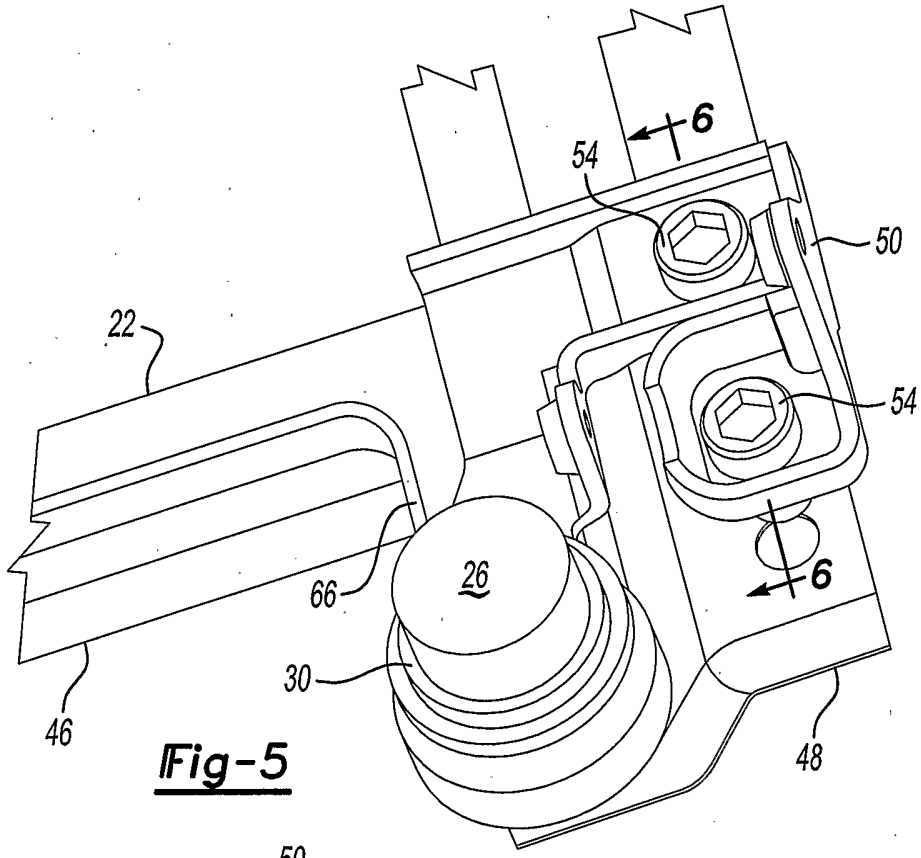

Fig-5

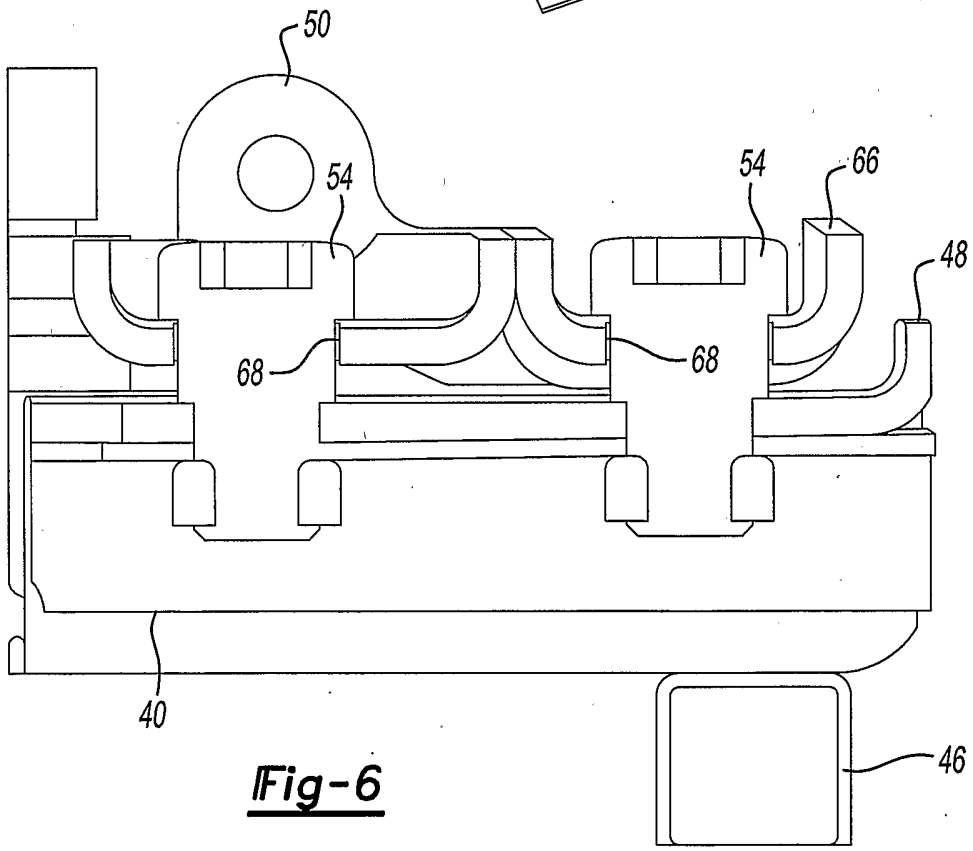

Fig-6

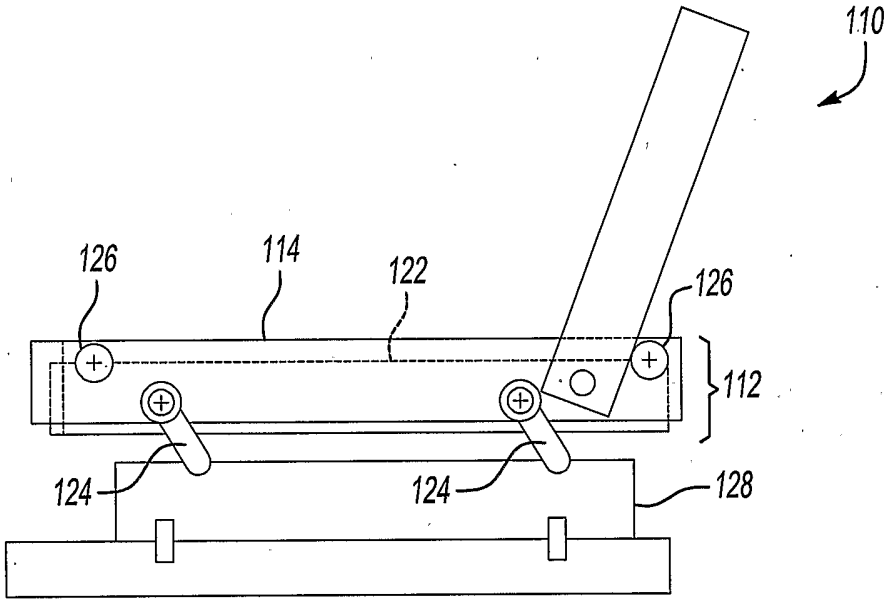

Fig-7

INTERNATIONAL SEARCH REPORT

International Application No
PCT/CA2004/000696

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B60N2/00 B60N2/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B60N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	DE 101 20 977 A (BIZERBA GMBH & CO KG) 14 November 2002 (2002-11-14) abstract; figure 2b	1,9
A	EP 0 950 560 A (TAKATA CORP) 20 October 1999 (1999-10-20) abstract; figure 1	1,9
A	US 5 670 853 A (BAUER BARNEY J) 23 September 1997 (1997-09-23) abstract; figure 1	1,9
A	US 6 546 817 B1 (AOKI HIROSHI) 15 April 2003 (2003-04-15) abstract; figure 8a	1,9

[ ] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
26 July 2004	30/07/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Pétiaud, A

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/CA2004/000696

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